

Table 6. Effect of rates of subjective happiness and pain (knee and back).

Variable	Intervention Group I (n=19)			Intervention Group II (n=14)			Greenhouse-Geisser p value
	Baseline	After 3 months	After 1 year follow-up	Baseline	After 6 months	After 1 year follow-up	
Subjective happiness (%) [*]	68.7 ± 11.8	71.0 ± 16.0	67.5 ± 18.8	68.1 ± 17.3	69.8 ± 17.2	68.5 ± 18.0	>0.05
Knee pain (%) [†]	17.2 ± 19.8	16.6 ± 25.6	15.6 ± 16.9	23.3 ± 21.1	24.0 ± 25.7	21.2 ± 17.9	>0.05
Back pain (%) [†]	23.5 ± 28.4	14.2 ± 21.5	20.5 ± 27.3	26.2 ± 20.1	17.7 ± 19.2	17.7 ± 17.1	0.025

Tested after root transform of knee and back pain (visual analogue scale)
mean ± standard deviation

* : 100%: maximal happiness, 0%: maximal unhappiness

† : 100%: maximal pain, 0%: no pain

Table 7. Psychological status and active modification of lifestyle.

Variable	Intervention Group I (n=19)			Intervention Group II (n=14)			Greenhouse-Geisser p value
	Baseline	After 3 months	After 1 year follow-up	Baseline	After 6 months	After 1 year follow-up	
POMS (T-score)							
- Tension	45.3 ± 6.3	43.2 ± 6.0	47.2 ± 6.9	44.3 ± 5.3	44.9 ± 4.6	43.5 ± 7.7	>0.05
- Depression	46.3 ± 6.1	46.0 ± 5.1	49.8 ± 8.9	47.4 ± 4.6	46.1 ± 5.0	45.6 ± 5.5	>0.05
- Anger	45.1 ± 6.6	44.3 ± 5.5	46.6 ± 6.2	46.3 ± 5.1	44.4 ± 4.0	44.2 ± 5.5	>0.05
- Vigor	52.3 ± 10.5	54.1 ± 8.1	52.7 ± 10.5	55.4 ± 6.3	60.3 ± 8.3	57.8 ± 8.7	0.047
- Fatigue	44.2 ± 6.0	43.5 ± 5.8	47.9 ± 7.6	45.2 ± 8.3	42.6 ± 5.0	42.7 ± 4.8	0.035
- Confusion	45.9 ± 7.5	45.2 ± 5.8	49.5 ± 7.8	47.3 ± 6.8	45.4 ± 5.9	46.2 ± 4.6	>0.05
Self-rating depression scale (pts)	31.8 ± 7.5	29.8 ± 5.6	32.1 ± 6.3	32.1 ± 6.3	29.7 ± 6.4	27.9 ± 6.1	0.045
Active modification of lifestyle (no.)	4.1 ± 2.1	4.8 ± 2.9	4.7 ± 2.4	4.7 ± 2.7	5.5 ± 2.6	5.2 ± 2.9	>0.05

mean ± standard deviation

one had any particular exercise habits at baseline. Eleven (58%) of 19 subjects temporarily joined short-term health classes held by the public administration, but no exercise habit in daily life was observed since then. Two (11%) started walking, and the remaining 6 (31%) were not involved in any exercise.

DISCUSSION

The subjects were recruited from individuals who underwent health checks in their municipality and were divided randomly into two groups. No significant differences were found between the two groups in any baseline values of age, underlying diseases, physical properties, blood profiles, and mental and psychological status. Therefore, the comparison of the two groups was assumed to be valid as a study design.

Group I of the 3-month intervention yielded good improvements in aerobic capacity, uric acid in serum, pains in the back, and tension immediately after the intervention, but the values tended to return to the baseline level at the 1-year follow-up. This indicates that a 2-hour intervention once a week for three months may not be sufficient.

According to the Transtheoretical model of behavior change (TTM) for exercise,¹⁷ supposedly, subjects in Group I were at Stage II (contemplation) when they first participated in the program because no one practiced any particular physical exercise prior to the intervention. The reduction of interventional effects during the 1-year follow-up period suggests that the subjects may have reached Stages III (preparation) or IV (action) by the intervention, but not Stage V (maintenance).

In Group II of the 6-month intervention, on the other hand, effects persisted in aerobic capacity, HbA_{1c}, pains in the back, vigor, fatigue and depression even at the 1-year follow-up. The attendance rate was very high (94.5%), in spite of the doubled number of sessions compared to Intervention I. Compliance on physical activity remained high during the following period as more than half of the Group II subjects participated in the voluntary exercise club. These facts exemplify that the most subjects in Group II have reached Stage V (maintenance) in TTM. The formation of a voluntary exercise club may be the result of group dynamics developed during the half-year of communication among participants, and of the supportive advice given by the staff (e.g., recommendations on location and teaching staff). To sustain the effects of intervention, these kinds of social support from the peer and staff members seem to be essential. Short-term intervention, such as once a week for three months, is an easy pattern to conduct as a program by the municipality. However, the above negative results of such a pattern provide valuable suggestions for health administration policies in order to achieve long-term goals. One indication is the necessity for longer intervention to support compliance, e.g., 6 months. Another indication is to add more instruction, for instance, instructions on daily life to modify and establish an active lifestyle. The influence of the frequency of intervention needs to be examined concerning the ben-

efits of more frequent intervention (more than once a week).

The present study was spread over two years from baseline to follow-up. Twelve subjects dropped out in Group II during the process. Because no significant differences were found between subjects who completed the process and the dropouts at baseline, this may have produced a type-II error. However, it is important to determine the reasons for these discontinuations in order for the health administration to examine methods of intervention. The dropouts were asked to tell why they left, if possible, or in a written note by mail if verbal communication was difficult. No subject indicated they dropped out because of dissatisfaction with this study. Their reasons included "emergence of new roles at home to take care of the more elderly or grandchildren," "getting a job," "hospitalization for an aggravated underlying disease" and "malignant tumor found." There may also have been underlying reasons such as difficult human relationships within the group.

The average age at the start of the intervention in Group II was 58.7 ± 7.1 years, which is one of the major transitional periods in life stage, and where preparation for further aging and shifts in present family relationships take place. This result may suggest a problem with long-term intervention (e.g., once a week for longer than six months) that tends to yield better benefits, but is likely to result in more dropouts. The lack of intention-to-treat analysis further limits the discussion.

Back pain was significantly alleviated in the 6-month intervention group in the present study. Strauss-Blasche et al conducted a monthly survey on mood and pains in 268 women who were treated for non-inflammatory chronic pains in the back and arthralgia at a hot spa clinic in Austria.¹⁸ They reported improved mood and pain relief in spring and autumn, and that temperature, pain, and mood are interrelated. In the present study, both follow-up evaluations made in June and December demonstrated positive effects. Taking into account the low temperature of winter and associated changes (levels of physical activity, appetite, etc.) as confounding factors, the effects of Group II, which underwent intervention during the winter, may be even higher than the indicated values including the outcomes of significant difference (e.g., PWC75%HR_{max} and HbA_{1c}). Seasonal confounding is one of the potential limitations in the present study.

In the current study, subjects first underwent lifestyle education and physical exercise for 60 min before bathing in an open-air hot salt spring for 60 min including time for changing clothes and washing the body. Relatively vigorous women of middle and advanced ages prefer bathing after physical exercise in general. However, Horikiri et al. reported that elderly people have more improved exercise tolerance after bathing.¹⁹ From the viewpoint of nursing care and illness prevention, the practice of light physical exercise (e.g., stretching) after bathing may be more appropriate for the somewhat frail elderly. Further research on suitable intervention methods in line with ADL, including timing of bathing, is important for building health with hot spa bathing.

This study concerns the effects of intervention using a combination of hot spa bathing, lifestyle education and physical exer-

cise for women of middle and advanced ages, but there is no control group of hot spa bathing alone. Therefore, the specific effects of the hot spa bathing can not be determined, which in turn limits the scope of discussion. The significant effects of the 6-month intervention, in particular, should be understood as an achievement from the standpoint of comprehensive health education programs that includes utilization of hot spa bathing.

It is assumed that combining health education programs and imposing certain active tasks on participants, as in the present study, is essential. Passive hot spa bathing alone would be difficult as a health policy for municipalities. The accumulation of RCT studies with diverse and realistic designs based on behavioral science is expected to clarify evidence for the effects of hot spa bathing.

The present study was an irregular randomized controlled trial, in which the control group was turned into an intervention group halfway through the study period. However, it was successful in showing that the once-a-week intervention for six months was likely to produce more effects than that same frequency for three months.

In conclusion, the beneficial effects of a 6-month intervention on HbA_{1c}, aerobic capacity, back pain, vigor, fatigue and depression remained significant at 1-year follow-up. Duration of benefits was longer in the 6-month intervention than in the 3-month intervention.

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